Identifying the Cause of High Concentrations of TBA in Ground Water at Gasoline Spill Sites in Orange County, CA

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Monitoring at gasoline spills in Orange County, CA, has revealed that TBA (tertiary butyl alcohol) is often present at high concentrations in ground water. To manage the hazard associated with the presence of TBA, staff of the UST Local Oversight Program (LOP) of the Orange County Health Care Agency needed to know the source of the TBA. There are several plausible sources: TBA has been used as an oxygenate in gasoline in some parts of the US, it is a component of technical MTBE used in gasoline, and it can be produced by biological degradation of MTBE to TBA.

When microorganisms degrade MTBE to TBA, they prefer molecules of MTBE containing the stable isotope ^{12}C and discriminate against molecules containing ^{13}C. The extent of biodegradation can be inferred from the shift in the ratio of ^{13}C to ^{12}C in the residual MTBE. To identify the source of TBA, the U.S. EPA, the Orange County LOP, and the University of Oklahoma formed a partnership. The EPA developed the criteria to recognize biodegradation, the Orange County LOP selected the sites for the study and arranged for sampling, and the University of Oklahoma performed the analyses to measure the ratio of ^{13}C to ^{12}C in MTBE in ground water. All three partners worked together to interpret the data.

A total of 13 sites were studied in detail. At 10 of the sites, natural anaerobic biodegradation of MTBE was clearly the most plausible explanation for the high concentrations of TBA in ground water. Considered in light of earlier EPA research, these results suggest that the very high levels of TBA measured in ground water at gasoline sites in Orange County are caused by the biological conversion of MTBE to TBA and the subsequent accumulation of TBA.

The Orange County LOP currently applies this new understanding of the behavior of MTBE to better evaluate risk and remediation at underground storage tank sites. On one hand, high concentrations of TBA can present a greater potential risk to ground water than MTBE alone. On the other hand, natural anaerobic conversion of MTBE to TBA represents a major paradigm shift in that MTBE was formerly considered to be recalcitrant to natural degradation. If it can be confirmed that TBA also degrades in ground water, these findings may lead to greater use of monitored natural attenuation, in conjunction with adequate source removal, as an alternative method to manage risk from gasoline spills